

09/856795  
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Practitioner's Docket No. U013484-1

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00140

PATENT TRADEMARK OFFICE

CHAPTER II

TRANSMITTAL LETTER  
TO THE UNITED STATES ELECTED OFFICE (EO/US)

(ENTRY INTO U.S. NATIONAL PHASE UNDER CHAPTER II)

PCT/IL99/00660                    3 DECEMBER 1999                    3 DECEMBER 1998  
INTERNATIONAL APPLICATION NO.    INTERNATIONAL FILING DATE    PRIORITY DATE CLAIMED

SUSTAINED RELEASE POLYMER-BASED WATER INSOLUBLE BEADS

TITLE OF INVENTION

1. ARNON SHANI
2. SHLOMO MAGDASSI
3. IDO YOSHA

APPLICANT(S)

Box PCT  
Assistant Commissioner for Patents  
Washington D.C. 20231  
ATTENTION: EO/US

NOTE: *The completion of those filing requirements that can be made at a time later than 30 months from the priority date results from the Commissioner exercising his judgment under the authority granted under 35 USC 371(d). The filing receipt will show the actual date of receipt of the last item completing the entry into the national phase. See 37 C.F.R.*

CERTIFICATION UNDER 37 C.F.R. 1.10\*

(Express Mail label number is **mandatory**.)  
(Express Mail certification is optional.)

I hereby certify that this correspondence and the documents referred to as attached therein are being deposited with the United States Postal Service on this date May 24, 2001, in an envelope as "Express Mail Post Office to Addressee," Mailing Label Number EL728213129US, addressed to the: Assistant Commissioner for Patents, Washington, D.C. 20231.

BARBARA D. SANTIAGO  
(type or print name of person mailing paper)

  
Signature of person mailing paper

**WARNING:** Certificate of mailing (first class) or facsimile transmission procedures of 37 C.F.R. 1.8 cannot be used to obtain a date of mailing or transmission for this correspondence.

**\*WARNING:** Each paper or fee filed by "Express Mail" **must** have the number of the "Express Mail" mailing label placed thereon prior to mailing. 37 C.F.R. 1.10(b).  
*"Since the filing of correspondence under § 1.10 without the Express Mail mailing label thereon is an oversight that can be avoided by the exercise of reasonable care, requests for waiver of this requirement will not be granted on petition." Notice of Oct. 24, 1996, 60 Fed. Reg. 56,439, at 56,442.*

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§1.491 which states: "An international application enters the national state when the applicant has filed the documents and fees required by 35 USC 371(c) within the periods set forth in § 1.494 and § 1.495."

**WARNING:** Where the items are those which can be submitted to complete the entry of the international application into the national phase are subsequent to 30 months from the priority date the application is still considered to be in the international state and if mailing procedures are utilized to obtain a date the express mail procedure of 37 C.F.R. §1.10 must be used (since international application papers are not covered by an ordinary certificate of mailing - See 37 C.F.R. §1.8).

**NOTE:** Documents and fees must be clearly identified as a submission to enter the national state under 35 USC 371 otherwise the submission will be considered as being made under 35 USC 111. 37 C.F.R. § 1.494(f).

1. Applicant herewith submits to the United States Elected Office (EO/US) the following items under 35 U.S.C. 371:
  - a. [X] This express request to immediately begin national examination procedures (35 U.S.C. 371(f)).
  - b. [X] The U.S. National Fee (35 U.S.C. 371(c)(1)) and other fees (37 C.F.R. § 1.492) as indicated below:

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## 2.Fees

CLAIMS FEE	(1) FOR	(2) NUMBER FILED	(3) NUMBER EXTRA	(4) RATE	(5) CALCULA- TIONS
[ * ]	TOTAL CLAIMS	52 - 20 =		x \$ 18.00 =	\$ 576.00
	INDEPENDENT CLAIMS	2 - 3 =		x \$ 80.00 =	
	MULTIPLE DEPENDENT CLAIM(S) (if applicable) + \$270.00				
BASIC FEE**	<p>[ ] U.S. PTO WAS INTERNATIONAL PRELIMINARY EXAMINATION AUTHORITY            Where an International preliminary examination fee as set forth in § 1.482 has been paid on the international application to the U.S. PTO:</p> <p>[ ] and the international preliminary examination report states that the criteria of novelty, inventive step (non-obviousness) and industrial activity, as defined in PCT Article 33(2) to (4) have been satisfied for all the claims presented in the application entering the national stage (37 CFR 1.492(a)(4)) ..... \$100.00</p> <p>[ ] and the above requirements are not met (37 CFR 1.492(a)(1)) ..... \$690.00</p> <p>[x] U.S. PTO WAS NOT INTERNATIONAL PRELIMINARY EXAMINATION AUTHORITY            Where no international preliminary examination fee as set forth in § 1.482 has been paid to the U.S. PTO, and payment of an international search fee as set forth in § 1.445(a)(2) to the U.S. PTO:</p> <p>[ ] has been paid (37 CFR 1.492(a)(2)) ..... \$710.00</p> <p>[ ] has not been paid (37 CFR 1.492(a)(3)) ..... \$1,000.00</p> <p>[x] where a search report on the international application has been prepared by the European Patent Office or the Japanese Patent Office (37 CFR 1.492(a)(5)) ..... \$860.00</p>				
	Total of above Calculations				
SMALL ENTITY	Reduction by ½ for filing by small entity, if applicable. Affidavit must be filed. (note 37 CFR 1.9, 1.27, 1.28)				
	Subtotal				
	Total National Fee				
	Fee for recording the enclosed assignment document \$40.00 (37 CFR 1.21(h)). (See Item 13 below). See attached "ASSIGNMENT COVER SHEET".				
TOTAL	Total Fees enclosed				
	\$ 718.00				

\*See attached Preliminary Amendment Reducing the Number of Claims.

- i.  A check in the amount of \$718.00 to cover the above fees is enclosed.
  - ii.  Please charge Account No. \_\_\_\_\_ in the amount of \$ \_\_\_\_\_.
- A duplicate copy of this sheet is enclosed.

**\*\*WARNING:** *"To avoid abandonment of the application the applicant shall furnish to the United States Patent and Trademark Office not later than the expiration of 30 months from the priority date: \* \* \* (2) the basic national fee (see § 1.492(a)). The 30-month time limit may not be extended." 37 C.F.R. § 1.495(b).*

**WARNING:** *If the translation of the international application and/or the oath or declaration have not been submitted by the applicant within thirty (30) months from the priority date, such requirements may be met within a time period set by the Office. 37 C.F.R. § 1.495(b)(2). The payment of the surcharge set forth in § 1.492(e) is required as a condition for accepting the oath or declaration later than thirty (30) months after the priority date. The payment of the processing fee set forth in § 1.492(f) is required for acceptance of an English translation later than thirty (30) months after the priority date. Failure to comply with these requirements will result in abandonment of the application. The provisions of § 1.136 apply to the period which is set. Notice of Jan. 3, 1993, 1147 O.G. 29 to 40.*

3.  A copy of the International application as filed (35 U.S.C. 371(c)(2)):

**NOTE:** *Section 1.495 (b) was amended to require that the basic national fee and a copy of the international application must be filed with the Office by 30 months from the priority date to avoid abandonment "The International Bureau normally provides the copy of the international application to the Office in accordance with PCT Article 20. At the same time, the International Bureau notifies applicant of the communication to the Office. In accordance with PCT Rule 47.1, that notice shall be accepted by all designated offices as conclusive evidence that the communication has duly taken place. Thus, if the applicant desires to enter the national stage, the applicant normally need only check to be sure the notice from the International Bureau has been received and then pay the basic national fee by 30 months from the priority date." Notice of Jan. 7, 1993, 1147 O.G. 29 to 40, at 35-36. See item 14c below.*

- a.  is transmitted herewith.
- b.  is not required, as the application was filed with the United States Receiving Office.
- c.  has been transmitted
  - i.  by the International Bureau.  
Date of mailing of the application (from form PCT/IB/308): \_\_\_\_\_.
  - ii.  by applicant on \_\_\_\_\_.  
Date \_\_\_\_\_

4.  A translation of the International application into the English language (35 U.S.C. 371(c)(2)):
- a.  is transmitted herewith.
  - b.  is not required as the application was filed in English.
  - c.  was previously transmitted by applicant on \_\_\_\_\_.  
Date \_\_\_\_\_
  - d.  will follow.

5. [x] Amendments to the claims of the International application under PCT Article 19 (35 U.S.C. 371(c)(3)):

**NOTE:** *The Notice of January 7, 1993 points out that 37 C.F.R. § 1.495(a) was amended to clarify the existing and continuing practice that PCT Article 19 amendments must be submitted by 30 months from the priority date and this deadline may not be extended. The Notice further advises that: "The failure to do so will not result in loss of the subject matter of the PCT Article 19 amendments. Applicant may submit that subject matter in a preliminary amendment filed under section 1.121. In many cases, filing an amendment under section 1.121 is preferable since grammatical or idiomatic errors may be corrected." 1147 O.G. 29-40, at 36.*

- a. [ ] are transmitted herewith.
  - b. [ ] have been transmitted
    - i. [ ] by the International Bureau.  
Date of mailing of the amendment (from form PCT/IB/308): \_\_\_\_\_.
    - ii. [ ] by applicant on \_\_\_\_\_.  
Date \_\_\_\_\_
  - c. [x] have not been transmitted as
    - i. [x] applicant chose not to make amendments under PCT Article 19.  
Date of mailing of Search Report (from form PCT/ISA/210): MAY 4, 2000.
    - ii. [ ] the time limit for the submission of amendments has not yet expired.  
The amendments or a statement that amendments have not been made will be transmitted before the expiration of the time limit under PCT Rule 46.1.
6. [x] A translation of the amendments to the claims under PCT Article 19 (38 U.S.C. 371(c)(3)):
  - a. [ ] is transmitted herewith.
  - b. [ ] is not required as the amendments were made in the English language.
  - c. [x] has not been transmitted for reasons indicated at point 5(c) above.
7. [x] A copy of the international examination report (PCT/IPEA/409)
  - [x] is transmitted herewith.
  - [ ] is not required as the application was filed with the United States Receiving Office.
8. [x] Annex(es) to the international preliminary examination report
  - a. [x] is/are transmitted herewith.
  - b. [ ] is/are not required as the application was filed with the United States Receiving Office.
9. [x] A translation of the annexes to the international preliminary examination report
  - a. [x] is transmitted herewith.
  - b. [ ] is not required as the annexes are in the English language.

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10. [x] An oath or declaration of the inventor (35 U.S.C. 371(c)(4)) complying with 35 U.S.C. 115
- a. [ ] was previously submitted by applicant on \_\_\_\_\_ Date
- b. [ ] is submitted herewith, and such oath or declaration
- i. [ ] is attached to the application.
- ii. [ ] identifies the application and any amendments under PCT Article 19 that were transmitted as stated in points 3(b) or 3(c) and 5(b); and states that they were reviewed by the inventor as required by 37 C.F.R. 1.70.
- c. [x] will follow.

Other document(s) or information included:

11. [x] An International Search Report (PCT/ISA/210) or Declaration under PCT Article 17(2)(a):
- a. [x] is transmitted herewith.
- b. [ ] has been transmitted by the International Bureau.  
Date of mailing (from form PCT/IB/308): \_\_\_\_\_.
- c. [ ] is not required, as the application was searched by the United States International Searching Authority.
- d. [ ] will be transmitted promptly upon request.
- e. [ ] has been submitted by applicant on \_\_\_\_\_ Date
12. [ ] An Information Disclosure Statement under 37 C.F.R. 1.97 and 1.98:
- a. [ ] is transmitted herewith.  
Also transmitted herewith is/are:  
[ ] Form PTO-1449 (PTO/SB/08A and 08B).  
[ ] Copies of citations listed.
- b. [ ] will be transmitted within THREE MONTHS of the date of submission of requirements under 35 U.S.C. 371(c).
- c. [ ] was previously submitted by applicant on \_\_\_\_\_ Date
13. [ ] An assignment document is transmitted herewith for recording.

A separate [ ] "COVER SHEET FOR ASSIGNMENT (DOCUMENT) ACCOMPANYING NEW PATENT APPLICATION" or [ ] FORM PTO 1595 is also attached.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

14. [x] Additional documents:
- a. [ ] Copy of request (PCT/RO/101)
  - b. [x] International Publication No. WO 00/32043
    - i. [x] Specification, claims and drawing
    - ii. [ ] Front page only
  - c. [ ] Preliminary amendment (37 C.F.R. § 1.121)
  - d. [x] Other

PCT/IPEA/409; PCT/IPEA/416

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15. [x] The above checked items are being transmitted
- a. [x] before 30 months from any claimed priority date.
  - b. [ ] after 30 months.
16. [ ] Certain requirements under 35 U.S.C. 371 were previously submitted by the applicant on \_\_\_\_\_, namely:
- 
- 
- 

#### AUTHORIZATION TO CHARGE ADDITIONAL FEES

**WARNING:** *Accurately count claims, especially multiple dependent claims, to avoid unexpected high charges if extra claims are authorized.*

**NOTE:** *"A written request may be submitted in an application that is an authorization to treat any concurrent or future reply, requiring a petition for an extension of time under this paragraph for its timely submission, as incorporating a petition for extension of time for the appropriate length of time. An authorization to charge all required fees, fees under § 1.17, or all required extension of time fees will be treated as a constructive petition for an extension of time in any concurrent or future reply requiring a petition for an extension of time under this paragraph for its timely submission. Submission of the fee set forth in § 1.17(a) will also be treated as a constructive petition for an extension of time in any concurrent reply requiring a petition for an extension of time under this paragraph for its timely submission." 37 C.F.R. § 1.136(a)(3).*

**NOTE:** *"Amounts of twenty-five dollars or less will not be returned unless specifically requested within a reasonable time, nor will the payer be notified of such amounts; amounts over twenty-five dollars may be returned by check or, if requested, by credit to a deposit account." 37 C.F.R. § 1.26(a).*

[X] The Commissioner is hereby authorized to charge the following additional fees that may be required by this paper and during the entire pendency of this application to Account No. 12-0425.

[X] 37 C.F.R. 1.492(a)(1), (2), (3), and (4) (filing fees)

**WARNING:** *Because failure to pay the national fee within 30 months without extension (37 C.F.R. § 1.495(b)(2)) results in abandonment of the application, it would be best to always check the above box.*

[ ] 37 C.F.R. 1.492(b), (c) and (d) (presentation of extra claims)

**NOTE:** *Because additional fees for excess or multiple dependent claims not paid on filing or on later presentation must*

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only be paid or these claims cancelled by amendment prior to the expiration of the time period set for response by the PTO in any notice of fee deficiency (37 C.F.R. § 1.492(d)), it might be best not to authorize the PTO to charge additional claim fees, except possible when dealing with amendments after final action.

- 37 C.F.R. 1.17 (application processing fees)
- 37 C.F.R. 1.17(a)(1)-(5)(extension fees pursuant to § 1.136(a)).
- 37 C.F.R. 1.18 (issue fee at or before mailing of Notice of Allowance, pursuant to 37 C.F.R. 1.311(b))

NOTE: Where an authorization to charge the issue fee to a deposit account has been filed before the mailing of a Notice of Allowance, the issue fee will be automatically charged to the deposit account at the time of mailing the notice of allowance. 37 C.F.R. § 1.311(b).

NOTE: 37 C.F.R. 1.28(b) requires "Notification of any change in loss of entitlement to small entity status must be filed in the application . . . prior to paying, or at the time of paying . . . issue fee." From the wording of 37 C.F.R. § 1.28(b): (a) notification of change of status must be made even if the fee is paid as "other than a small entity" and (b) no notification is required if the change is to another small entity.

- 37 C.F.R. § 1.492(e) and (f) (surcharge fees for filing the declaration and/or filing an English translation of an International Application later than 30 months after the priority date).



SIGNATURE OF PRACTITIONER

Reg. No.: 25,858

WILLIAM R. EVANS  
(type or print name of practitioner)

Tel. No.: (212) 708-1930

P.O. Address

Customer No.: 00140

c/o Ladas & Parry  
26 West 61<sup>st</sup> Street  
New York, N.Y. 10023

Rec'd PCT/PTO 14 AUG 2001  
09/856795

Practitioner's Docket No. U013484-1

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

[x] In re application of: Arnon SHANI, et al.

Application No.: 09/856,795

Filed: May 24, 2001

For: SUSTAINED RELEASE POLYMER-BASED WATER INSOLUBLE BEADS

Group No.:

Examiner:

[ ] \*Patent No.:

Issue Date:

\*NOTE: Insert name(s) of inventor(s) and title also for patent Where statement is with respect to a maintenance fee payment, also insert application number and filing date, and add Box M. Fee to address.

**STATEMENT CLAIMING SMALL ENTITY STATUS (37 CFR 1.9(c-f) and 1.27(b-d))**

With respect to the invention described in

[ ] the specification filed herewith.

[x] application no. 09/856,795, filed May 24, 2001.

[ ] patent no. \_\_\_\_\_ issued \_\_\_\_\_.

**I. IDENTIFICATION AND RIGHTS AS A SMALL ENTITY**

I hereby state that I am

(complete either (a), (b), (c) or (d) below)

(a) Independent Inventor

[ ] a below named independent inventor, and that I qualify as an independent inventor, as defined in 37 CFR 1.9(c), for purposes of paying reduced fees under Sections 41(a) and (b) of Title 35, United States Code, to the Patent and Trademark Office.

(b) Noninventor Supporting a Claim by Another

[ ] making this statement to support a claim by

---

for a small entity status for purposes of paying reduced fees under Sections 41(a) and (b) of Title 35, United States Code. I hereby state that I would qualify as an independent inventor as defined in 37 CFR 1.9(c) for purposes of paying reduced fees under Sections 41(a) and (b) of Title 35, United States Code, if I had made the above identified invention.

(c) Small Business Concern

[ ] the owner of the small business concern identified below:

*check one* → [ ] an official of the small business concern empowered to act on behalf of the concern identified below:

Name of Concern \_\_\_\_\_  
Address of Concern \_\_\_\_\_

and  
that the above identified small business concern qualifies as a small business concern, as defined in 13 CFR 121.3-18, and reproduced in 37 CFR 1.9(d), for purposes of paying reduced fees under Sections 41(a) and (b) of Title 35, United States Code, in that the number of employees of the concern, including those of its affiliates, does not exceed 500 persons. For purposes of this statement, (1) the number of employees of the business concern is the average over the previous fiscal year of the concern of the persons employed on a full-time, part-time or temporary basis during each of the pay periods of the fiscal year, and (2) concerns are affiliates of each other when either, directly or indirectly, one concern controls or has the power to control the other, or a third party or parties controls or has the power to control both.

(d) Non-Profit Organization

an official empowered to act on behalf of the nonprofit organization identified below:

Name of Organization BEN GURION UNIVERSITY OF THE NEGEV RESEARCH DEVELOPMENT AUTHORITY  
Address of Organization P.O. BOX 653, 84105 BEER SHEVA, ISRAEL

TYPE OF ORGANIZATION

University or Other Institution of Higher Education  
 Tax Exempt Under Internal Revenue Service Code (26 USC 501(a) and 501(c) (3))

Nonprofit Scientific or Educational Under Statute of State of the United States of America

(Name of State \_\_\_\_\_)  
(Citation of Statute \_\_\_\_\_)

Would Qualify as Tax Exempt Under Internal Revenue Service Code (26 USC 501(a) and 501(c) (3)), if Located in the United States of America

Would Qualify as Nonprofit Scientific or Educational Under Statute of State of the United States of America, if Located in the United States of America

(Name of State \_\_\_\_\_)  
(Citation of Statute \_\_\_\_\_)

and that the nonprofit organization identified above qualifies as a nonprofit organization, as defined in 37 CFR 1.9(e), for purposes of paying reduced fees under Sections 41(a) and (b) of Title 35, United States Code.

## II. OWNERSHIP OF INVENTION BY DECLARANT

I hereby state that rights under contract or law remain with and/or have been conveyed to the above identified

person  
(item (a) or (b) above)

concern  
(item (c) above)

organization  
(item (d) above)

**Prof. Zamik Rosenwaks**  
Vice - President and Dean  
for Research and Development  
BEN-GURION UNIVERSITY OF THE NEGEV

EXCEPT, that if the rights held are not exclusive, each individual, concern or organization having rights to the invention is listed below\* and no rights to the invention are held (1) by any person who could not be classified as an independent inventor under 37 CFR 1.9(c) if that person had made the invention, (2) any concern which would not qualify as a small business concern under 37 CFR 1.9(d) or (3) a nonprofit organization under 37 CFR 1.9(e).

- no such person, concern, or organization  
 person, concerns or organizations listed below\*

\*NOTE: Separate statements are required from each named person, concern or organization having rights to the invention as to their status as small entities. (37 CFR 1.27)

Full Name BEN GURION UNIVERSITY OF THE NEGEV RESEARCH AND DEVELOPMENT AUTHORITY

Address P.O. BOX 653, 84105 BEER SHEVA, ISRAEL

INDIVIDUAL       SMALL BUSINESS CONCERN       NONPROFIT ORGANIZATION

**Prof. Zviik Rosenwaks**

Vice - President and Dean

for Research and Development

BEN-GURION UNIVERSITY OF THE NEGEV

*Z. Rosen*

Full Name \_\_\_\_\_

Address \_\_\_\_\_

INDIVIDUAL       SMALL BUSINESS CONCERN       NONPROFIT ORGANIZATION

### **III. ACKNOWLEDGEMENT OF DUTY TO NOTIFY PTO OF STATUS CHANGE**

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. (37 CFR 1.28(b))

### **IV. DECLARATION**

(check the following item, if desired)

NOTE: The following verification statement need not be made in accordance with the rules published on October 10, 1997, 62 Fed. Reg. 52131, effective December 1, 1997

NOTE: "The presentation to the Office (whether by signing, filing, submitting, or later advocating) of any paper by a party, whether a practitioner or non-practitioner, constitutes a certification under § 10.18(b) of this chapter. Violations of § 10.18(b)(2) of this chapter by a party, whether a practitioner or non-practitioner, may result in the imposition of sanctions under § 10.18(c) of this chapter. Any practitioner violating § 10.18(b) may also be subject to disciplinary action. See §§ 10.18(d) and 10.23(c)(15)." 37 CFR 1.4(d)(2).

- I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

**V. SIGNATURES**

(complete only (e) or (f) below)

(e)

NOTE: All inventors must sign the statement.

ARNON SHANI

Name of Inventor

D. Shani

Date: 25.7.2001

Signature of Inventor

SHALOMO MAGDASSI

Name of Inventor

Date: 25.7.2001

Signature of Inventor

IDO YOSHA

Name of Inventor

Date: 25.7.01

Signature of Inventor

Ido Yosha

(add lines for any additional inventors who must sign)

or

(f)

NOTE: The title of the person signing on behalf of a concern or nonprofit organization should be specified.

Name of Person Signing (X)

Title of Person (X)

(if signing on behalf of a concern or non-profit organization)

Address of Person Signing P.O. BOX 653, 84105 BEER SHEVA, ISRAEL

SIGNATURE (X)

Z. Rosenwaks

DATE (X)

5<sup>th</sup> July 2001

**Prof. Zamik Rosenwaks**

Vice - President and Dean  
for Research and Development  
BEN-GURION UNIVERSITY OF THE NEGEV

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SUSTAINED RELEASE POLYMER-BASED WATER INSOLUBLE BEADS

The present invention relates to a sustained release dispersion of water insoluble beads and to a process for the preparation thereof. More particularly, the present invention relates to a sustained release dispersion of water insoluble beads each bead comprising a polymeric matrix comprised of a protein and a polysaccharide and containing at least one volatile hydrophobic component for release therefrom in atmospheric air.

U.S. Patents 4,400,391 and 4,401,456 describe and claim alginate gel beads containing bioactive materials dispersed therein. These beads can be made to either float or sink in aqueous environments, and are capable of providing the controlled release of their bioactive materials when applied to terrestrial or aqueous environments.

The prior art deals with the controlled and/or sustained release of various materials from polysaccharide beads such as from alginate gel beads into aqueous or wet environments, however the release of hydrophobic volatile materials into the atmosphere from such a bead is neither taught nor suggested in the prior art.

With this state of the art in mind, there is now provided according to the present invention a sustained release dispersion of water insoluble beads, each bead comprising a polymeric matrix comprised of a protein and a polysaccharide and containing a plurality of emulsion droplets, said droplets being formed from at least one surface active molecule, at least one volatile hydrophobic component and water, wherein said volatile component is released from said water insoluble bead in atmospheric air.

In especially preferred embodiments of the present invention, said polysaccharide is selected from the group consisting of sodium alginate, carragenan, guar gum, locus bean gum, chitosan, pectin carboxy methyl cellulose.

AMENDED SHEET

In other preferred embodiments of the present invention, said protein is selected from the group consisting of gelatin, albumin, casein and Lactoglobulin.

In preferred embodiments of the present invention said surface active molecule is selected from the group consisting of a protein, a monomeric surfactant and a polymeric surfactant.

In especially preferred embodiments of the present invention, said surface active molecule is selected from the group consisting of ethoxylated sorbitan ester, alkyl ether, a block copolymer and geletin.

Preferably, said bead is of a size between 0.5 micron and 1 mm and especially preferred are beads of a size between 5 and 80 microns.

In preferred embodiments of the present invention said volatile component is an attractant which is preferably selected from the group consisting of eugenol, benzyl alcohol, leaf alcohols, aldehydes and acetates.

In other preferred embodiments of the present invention said volatile component is an attractant inhibitor which is preferably selected from the group consisting of (Z)-9-tetradecenyl formate and (E,E)-10,12-hexadecadienol.

In another aspect of the present invention there is now provided a process for preparing sustained-release polymer-based water insoluble beads for release of a volatile hydrophobic component therefrom in atmospheric air, comprising:

- a) preparing an oil/water emulsion by homogenizing a volatile hydrophobic component in water, using at least one surface active molecule;
- b) mixing said emulsion with at least one water-soluble polymer and optionally rehomogenizing the mixture; and
- c) adding the emulsion prepared in step (b) in a dropwise manner into a gellant solution to form said water insoluble beads.

2a

In preferred embodiments of the present invention said process further comprises the step of chemically cross-linking polymers present in said composition and further comprises the step of drying said beads.

The beads prepared by the process of this invention are useful in providing sustained release of volatile materials contained therein, when exposed to the atmosphere. As long as the dispersion of beads are kept in water, the volatile material is not released.

Said oil in water emulsion is preferably prepared by homogenization of the volatile hydrophobic component in a gelatin solution. A water-soluble salt of alginic acid is mixed with water and added to the solution. The mixture is then homogenized again, and added dropwise into an aqueous solution of di-, tri- or quatra-valent metal salt (called the gellant solution) that will cause the alginate to form gel. As each drop comes in contact with the metal salt solution, the gelation is initiated and a bead forms. Further treatment of the water insoluble beads with tannic acid solution over night is possible if an extended delay of the release of the volatile material is desired.

More particularly, the invention describes the process and the product, which is the formulation for a slow release of pheromones.

The abstract of JP 58 121212 (D1) discloses a gel like body for sustained release of a volatile substance. The polymer is comprised of sodium polyacrylate having at least one epoxy group per molecule and a cationic surfactant. The resulting gel like body which is composed of synthetic polymers is different from the polymeric beads of the present invention, which are based on biopolymers, proteins and polysaccharide. The use of biopolymers has significant advantages based on environmental considerations.

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GB 2, 129,302 (D2) describes a method of treating a ground area with a substance which is dispersed within a polymeric material. The method of preparation of the product described therein is completely different from that of the present invention and is based on polymerization of synthetic monomers, which forms a large body of polymeric material, which has to be sliced or diced or otherwise divided into small particles. In contradistinction the present invention deals only with biopolymers and the cross-linking of polymers which were already formed by multivalent electrolytes leading to small particles. In addition, since this method is based on chemical reaction, the monomers may react with the active substance.

US Patent 4,401,456 (D3) describes a method for preparing alginate beads containing bioactive material, which mainly is released by leaching. The beads do not contain, as in the present invention, a protein, in addition to the alginate and said patent suggests only the use of alginate and not the use of other polysaccharides.

GB 2,141,932 (D4) discloses pest control composition based on a pheromone in a liquid or semi-liquid polymeric water resistant matrix allowing sustained release of the pheromone. Unlike the present invention, the composition is not based on beads, does not contain water and surfactant, and is based on synthetic polymers.

EP 0 617 051 describes polymeric compositions for controlled release of substances, in the form of emulsions which are used for impregnation or coating articles. In said Patent, unlike the present invention, the polymers are synthetic and the active substance is in direct contact with the monomers and therefore may react with the monomers and lose its activity.

In Journal of Economic Entomology, 82(6), 1 December 1989, pages 1830-1835, Meinke L J et al: describes a pheromone delivery system which is encapsulated in a starch borate matrix. The formulation is completely different than the compositions described in the present invention.

DETAILED DESCRIPTION OF THE PRESENT INVENTION

In substantial similarity to U.S. 4,401, 456, the simplicity of requirements needed for carrying out the process of the present invention permits much latitude in design of equipment. A suitable apparatus, as described below, is brought only for the purpose of illustration and not to be construed as limiting the invention. The apparatus consists of a reservoir to contain the alginate/protein/volatile- material/water emulsion that is equipped with a stopcock or similar device that allows the dropwise addition of the mixture through an orifice. The gellant solution may be contained in any convenient vessel.

After a suitable amount of time within the gellant solution, the resulting gel beads are removed by means such as filtration, screening, or straining. They may be rinsed in plain water if desired.

Beads may be further stirred in tannic acid solution and then rinsed again if a longer release-time of the volatile material is desired

The beads can be used in this fully hydrated state or dried to any desired moisture content without losing their effectiveness. Small hard granules result when the beads are dried. The hydrophobic oil which is present within the beads, e.g. a pheromone, can be released slowly, to the atmosphere. The rate of release can be sustained by suitable selection of the concentration of the alginate, proteins, tannic acid and additional components such as polyethylene glycol, urea and electrolytes.

The rate of addition of the mixture from the reservoir is a function of orifice size and the number of orifices used. The above rate can be increased by applying air or piston pressure.

The distance between the orifice and the surface of the gellant solution should be far enough to allow the droplet to penetrate the surface of the gellant solution.

The size of the resulting alginate gel beads depends on the viscosity of the alginate/volatile material/water mixture, the amount of water retained in the beads, and orifice size. An orifice of 0.1-5 mm in diameter is suitable, but the preferred range is 0.8-2 mm. Beads will be generally spherical or ellipsoidal with an average diameter of 0.1-6 mm. Smaller beads, down to micron in size, may be prepared by spraying the alginate/volatile material/water mixture into the gellant bath.

A continuous process of producing beads is possible and requires continuous removal of gel beads and maintenance of the gellant concentration. It is also possible to extrude the alginate/volatile- material/ water mixture into the gellant to form a string-like gel, which can be cut into various lengths or dried and ground into granules.

Hydrated (undried) beads will usually be stored in water. The well-known phenomenon of syneresis can occur with alginate gels as well as with many other polysaccharide gels. Specifically, it is the loss of fluid (mostly water in the present invention), from the gel caused by contraction. Most of the fluid loss occurs within the 24-hour period after preparation, but it can continue for a few weeks before coming to equilibrium. Some factors that influence the amount of syneresis are alginate composition, cross-linking of the gelatin with tannic acid, temperature, gellant and the chemical nature of the volatile material. Usually the fluid that is exuded during the first 36 hours, is principally water and only a relatively small amount of volatile material is lost.

The protein used in the emulsion preparation of the present invention is a B type gelatin, but other proteins may be used as well. The concentration of the protein may vary widely and will influence the release rate of the volatile component/s.

The alginates used in the invention are any water-soluble salts of alginic acid. These include sodium, potassium, magnesium and ammonium alginate, and

the alginates of organic bases such as amines. Sodium alginate is preferred. The viscosity of the alginate may vary and will influence gel strength to some degree. Highly refined alginates are not required for the practice of this invention.

An especially preferred alginate is the alginic acid, sodium salt, LX0450, available from MCB Manufacturing Chemists Inc., Cincinnati, Ohio, having a bulk density of 43 lbs./cu ft, a pH of 7.2 in a 1% aqueous solution, and a viscosity (run with a Brookfield LVF @ 60 RPM) of 400 @ 1% and 3500 @ 2%.

Concentration of the alginate formulated in the initial alginate/volatile material/water mixture is 0.1-3% by weight, but 1-1.5% is usually preferred. The volatile materials referred to in this invention are any volatile bioactive materials, such as pheromones, essential oils, pesticides, fragrances, etc.

The excellent chemical compatibility of alginates allows admixture according to the present invention with a very wide choice of volatile materials such as those described above. They are too numerous to list in their entirety. The following are only a few of the pheromones that can be used, given for the purpose of illustration and should not be construed as limiting the scope of the invention. The common name is given first, followed by the chemical name.

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Common name	6	Chemical name
Muscamone		(Z)-9-tricosene
Gossyplure		(ZZ)-7,11-hexadecadien-1-ol acetate, and (Z,E)-7,11-hexadecadien-1-ol acetate
Disparlure		cis-7,8-epoxy-2-methyloctadecane
Grandlure		(1 <i>R</i> -cis)-1-methyl-2-(1-methylethenyl cyclobutaneethanol; (Z)-2-(3,3-dimethylcyclohexylidene)ethanol (Z)-(3,3-dimethylcyclohexylidene) acetaldehyde; and (E)-(3,3-dimethylcyclohexylidene) acetaldehyde

It is an important part of this invention that additional control over rate of release of these types of volatile materials may be achieved. This may be achieved by interaction between the components of the formulation with the active materials.

Concentration of the volatile material formulated in the alginate/protein/volatile material/water mixture can be as high as 50% by weight, but is preferably in the range of 0.1-20%. The ingredients of this mixture may be incorporated in any order desired prior to the emulsification process. The preferred pH range of the mixture is 4-12. The usual and preferred temperature of the mixture is 20-30°C, but may be higher to reduce viscosity.

Cations that will gel alginate solutions are the cations of barium, lead, copper, iron, strontium, cadmium, calcium, zinc, nickel, aluminum, tin, acid ( $H^+$ ), and mixtures of these. The gellant solution of the present invention consists of an aqueous solution of a soluble and ionized salt of a metal listed above, an acid, or a mixture of these. Choice of gellant will have an effect on gel properties and possibly on the release rate of the volatile material dispersed in the alginate gel bead. The preferred gellants are the chlorides and acetates of calcium, barium and copper; the preferred acids are hydrochloric and acetic. Concentration of the metal salt or acid in the gellant solution may be up to 50% by weight, though 1-15% is preferred. Gelation proceeds faster as the concentration is increased. Reaction with sodium alginate and certain volatile materials will reduce the effective concentration of gellant cations, therefore a sufficient concentration must be maintained to provide the desired properties.

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Temperature of the gellant solution can affect gel properties. It is an advantage of the present invention, which involve volatile materials that heat does not have to be employed and most products can be made at 1-30°C. The preferred range is 20-30°C. However, any temperature up to, and including, the boiling point of the gellant solution may be used. Reaction of the alginate/volatile material/water mixture with the gellant solution is very rapid and produces a distinct gel bead immediately. Gelation proceeds from the outer surface to the center of the bead. Final gel properties such as hardness, pore size, surface area, strength, elasticity, size, durability, and release rate of the volatile material are influenced by the time within the gellant solution and should be optimized for each product. Generally, a residence time of 0.1-25 minutes may be used, but 1-10 minutes is usually sufficient.

In certain applications it may be desirable to add other ingredients to the alginate/volatile material/water mixture or to the gellant solution, or to the final gel beads. These additives may serve to alter the rate of release of the volatile material, protect the gel beads from microbial attack or oxidation, facilitate the preparation process or reduce syneresis. They include solubilizing agents, biocides such as formaldehyde, enzymes, organic solvents, surfactants, viscosity modifiers, filmforming agents, natural and synthetic gums, sequestering agents, starch, talc, fibers, light-screening chemicals and antioxidants.

Sustained release refers to formulations or materials that dispense their active ingredients into the environment over a period of time in a constant rate. For the purpose of this invention this time period can be short and measured in minutes or hours, or long and measured in days or even months. In the present invention, release of the volatile material from the alginate beads occurs through processes such as leaching, diffusion, dissolution, and degradation in atmospheric air.

Sustained release materials may be used to reduce the number of applications needed to perform a certain task, permit an effective (while not too high) concentration in the environment at any one time, and enhance effectiveness against the target species.

This invention is suitable for producing alginate gel beads containing volatile material, said beads being useful for agricultural, industrial, domestic and health-related purposes.

While the invention will now be described in connection with certain preferred embodiments in the following examples so that aspects thereof may be more fully understood and appreciated, it is not intended to limit the invention to these particular embodiments. On the contrary, it is intended to cover all alternatives, modifications and equivalents as may be included within the scope of the invention as defined by the appended claims. Thus, the following examples which include preferred embodiments will serve to illustrate the practice of this invention, it being understood that the particulars shown are by way of example and for purposes of illustrative discussion of preferred embodiments of the present invention only and are presented in the cause of providing what is believed to be the most useful and readily understood description of formulation procedures as well as of the principles and conceptual aspects of the invention.

#### EXAMPLE 1

3 grams of gelatin type B were dissolved in 97 grams of water. 5 grams of dodecyl acetate and 3.4 grams of water were added to 16.6 grams of the solution, and the mixture was homogenized for 5 minutes (9500 R.P.M). 2 grams of sodium alginate were dissolved in 98 grams of water, and 25 grams of the solution were added to the solution of gelatin and dodecyl acetate. The whole mixture was homogenized for 5 minutes (9500 R.P.M).

The solution was added dropwise through a syringe equipped with a 22G x 1 ½ needle, falling a distance of 60 mm, into 150 ml of 1% CaCl<sub>2</sub> solution. The CaCl<sub>2</sub> solution was contained in a 150 mm diameter vessel, and stirred with a magnetic stirrer in a rate of about 120 R.P.M. The rate of addition was such that 5 minutes were required for the 50g addition to take place. The beads formed (2 mm idiameter) were left in the solution for 5 additional minutes. The beads were then separated by filtration through a sieve, washed in water and stored in water. When air-dried, the beads became hard granules of about 1 mm in diameter.

Release rate was measured – see sample A in Table 1.

#### EXAMPLE 2

Beads were made in the same manner as in example 1, using CaCl<sub>2</sub> 0.25% as the gellant solution.

Release rate was measured – see sample B in Table 1.

EXAMPLE 3

Beads were made in the same manner as in example 1, using  $\text{CaCl}_2$  0.1% as the gellant solution.

Release rate was measured – see sample C in Table 1.

EXAMPLE 4

Beads were made in the same manner as in example 1, with 1% gelatin as the protein.

Release rate was measured – see sample D in Table 1.

EXAMPLE 5

Beads were made in the same manner as in example 1, with 0.5% gelatin as the protein.

Release rate was measured – see sample E in Table 1.

EXAMPLE 6

Beads were made in the same manner as in example 1, with 0.6% alginate.

Release rate was measured – see sample F in Table 1.

EXAMPLE 7

Alginate beads containing dodecyl acetate were prepared as in example 1, but using  $\text{FeCl}_3$  as the gellant solution.

EXAMPLE 8

Alginate beads containing dodecyl acetate were prepared as in example 1, but using  $\text{SnCl}_4$  as the gellant solution.

EXAMPLE 9

Alginate beads containing dodecyl acetate were prepared as in example 1, but the beads formed were left over night in a 1% tannic acid solution. The beads were then washed in water and stored in water.

Release rate was measured – see sample G in Table 1.

EXAMPLE 10

3 grams of gelatin were dissolved in 97 grams of water. 5 grams of Gossyplure (Pink Bollworm pheromone) and 3.4 grams of water were added to 16.6 grams of the solution, and the mixture was homogenized for 5 minutes (9500 R.P.M). 2 grams of sodium alginate were dissolved in 98 grams of water, and 12.5 grams of the solution were added to the solution of gelatin and Gossyplure. The whole mixture was homogenized for 5 minutes (9500 R.P.M). The resulting

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emulsion was processed as in example 1 to produce alginate gel beads containing Gossyplure.

Release rate was measured – see sample H in Table 1 and Figure 1.

#### EXAMPLE 11

3 grams of gelatin were dissolved in 97 grams of water. 5 grams of Eugenol and 3.3 grams of water were added to 16.6 grams of the solution, and the mixture was homogenized for 5 minutes (9500 R.P.M). 3 grams of sodium alginate were dissolved in 97 grams of water, and 25 grams of the solution were added to the solution of gelatin and Eugenol. The whole mixture was homogenized for 5 minutes (9500 R.P.M).

The solution was added dropwise through a syringe equipped with a 18G x 1 ½ needle, falling a distance of 500 mm, into 150 ml of 0.25% CaCl<sub>2</sub> solution. The CaCl<sub>2</sub> solution was contained in a 150 mm diameter vessel, and stirred with a magnetic stirrer in a rate of about 120 R.P.M. The rate of addition was such that 5 minutes were required for the 50g addition to take place. The beads formed (2 mm in diameter) were left in the solution for 5 additional minutes. The beads were then separated by filtration through a sieve, washed in water and left overnight in a 1% tannic acid solution. The beads were then washed and stored in water. When air-dried, the beads became hard granules of about 0.5 mm in diameter.

Release rate was measured – see sample I in Table 1.

#### EXAMPLE 12

Beads were made from an emulsion of 10% Eugenol, 1% gelatin and 1.5% alginate, in the same manner described above. The beads were placed in traps that were placed in a peanut- field. Together with these traps, reference traps that contained live virgin females of the beetle *Maladera Matrida Argaman* were placed in the field. After ten days, the traps containing the eugenol beads trapped as many beetles as the traps with the live females.

#### EXAMPLE 13

Beads were made from an emulsion of 10% pheromone of the *Pink Bollworm* moth, 1% gelatin and 1% alginate, in the same manner described above. The beads were placed in bags, containing 200 mg of dry beads each. 25 bags were placed in a cotton field, forming a square of 50X50 meters. Reference traps containing pheromone impregnated in cardboard were placed in the middle of the

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square and in the field, away from the experiment. In a 43 day period, the reference traps in the field around the experiment trapped much more moths than the trap in the middle of the square as described in Table 2 hereinafter:

EXAMPLE 14

3 grams of gelatin Type B 75 Bloom were dissolved in 97 grams of water. 5 grams of pink boilworm pheromone and 3.4 grams of water were added to 16.6 grams of the solution, and the mixture was homogenized for 5 minutes (9500 R.P.M). 2 grams of sodium alginate were dissolved in 98 grams of water, and 25 grams of the solution were added to the solution of gelatin and dodecyl acetate. The whole mixture was homogenized for 5 minutes (9500 R.P.M). The solution was sprayed through an atomizer (BETE fog nozzle FC7, 1/4 XA, cap AC1201) into 150 ml of 1% CaCl<sub>2</sub> solution. The CaCl<sub>2</sub> solution was contained in a 150 mm diameter vessel, and stirred with a magnetic stirrer in a rate of about 120 R.P.M. The rate of spraying was such that few seconds were required for the 50 g addition to take place. The beads formed (0.01-0.3 mm in diameter) were left in the solution for 5 additional minutes. The beads were then separated by filtration through a sieve, washed in water and stored in water. When dried in room temperature, the beads became hard granules of about 0.005-0.15 mm in diameter. Release rate was measured outdoors over prolonged period of time, and it was found that the formulation yields a slow release of the volatile hydrophobic component. The amounts released were as described in Table 3, and in sample J in Table 1.

EXAMPLE 15

Micron-size particles were prepared as in example 14, but using gelatin Type B 225 Bloom as the protein.

The sprayable formulation (micron size particles in 50 ml of water) was added to 15 L of water and sprayed in a cotton field using a backpack sprayer. Release rate was measured outdoors over prolonged period of time, and it was found that the formulation yields a slow release of the volatile hydrophobic component. The amounts released were as described in Table 3, and in sample K in Table 1.

Reference traps containing pheromone impregnated in cardboard were placed in the middle of the square and in the field, away from the experiment. In a 21 days

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period, the reference traps in the field around the experiment trapped much more moths than the trap in the middle of the square as described in Table 4.

EXAMPLE 16

3 grams of gelatin type B 75 Bloom were dissolved in 97 grams of water. 5 grams of Codling moth pheromone and 3.4 grams of water were added to 16.6 grams of the solution, and the mixture was homogenized for 5 minutes (9500 R.P.M). 24 grams of acrylate solution (Joncrys SCX 8089) were dissolved in 6 grams of water, and 25 grams of the solution were added to the solution of gelatin and pheromone. The whole mixture was homogenized for 5 minutes (9500 R.P.M).

The solution was added dropwise through a syringe equipped with a 22G x 1 ½ needle, falling a distance of 60 mm, into 150 ml of 5%  $\text{CaCl}_2$  solution. The  $\text{CaCl}_2$  solution was contained in a 150 mm diameter vessel, and stirred with a magnetic stirrer in a rate of about 120 R.P.M. The rate of addition was such that 5 minutes were required for the 50g addition to take place. The beads formed (2 mm in diameter) were left in the solution for 5 additional minutes. The beads were then separated by filtration through a sieve, washed in water and stored in water. When air-dried, the beads became hard granules of about 1 mm in diameter.

EXAMPLE 17

Beads were made in the same manner as in example 1, using Codling moth pheromone.

EXAMPLE 18

An emulsion was made in the same manner as in example 16. The emulsion was added to a gellant solution of  $\text{CaCl}_2$  5% using a spraying device as in Example 14, to form micron size particles.

EXAMPLE 19

An emulsion was made in the same manner as in example 16 and added dropwise to 150 ml of glacial acetic acid to form beads of around 2 mm in diameter. The beads were left in the acid for about 5 minutes and then filtered and washed thoroughly with water to remove the acid.

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EXAMPLE 20

An emulsion was made in the same manner as in example 16. The emulsion was added to a glacial acetic acid using a spraying device as in example 14, to form micron size particles. The particles were left in the acid for few minutes and then filtered and washed with water and kept wet in water.

EXAMPLE 21

0.5 g of Tween 80 were added to 5 grams of Codling- moth pheromone and 19.5 grams of water, and the mixture was homogenized for 5 minutes (9500 R.P.M). 2 g of sodium alginate were dissolved in 98 grams of water, and 25 grams of the solution were added to the emulsion of the pheromone and Tween 80. The whole mixture was homogenized for 5 minutes (9500 R.P.M).

The solution was added dropwise through a syringe equipped with a 22G x 1 ½ needle, falling a distance of 60 mm, into 150 ml of 5% CaCl<sub>2</sub> solution. The CaCl<sub>2</sub> solution was contained in a 150 mm diameter vessel, and stirred with a magnetic stirrer in a rate of about 120 R.P.M. The rate of addition was such that 5 minutes were required for the 50g addition to take place. The beads formed (2 mm in diameter) were left in the solution for 5 additional minutes. The beads were then separated by filtration through a sieve, washed in water and stored in water. When air-dried, the beads became hard granules of about 1 mm in diameter.

EXAMPLE 22

An emulsion was made in the same manner as in example 21. The emulsion was added to a gellant solution of CaCl<sub>2</sub> 1% using a spraying device as in example 14, to form micron size particles.

EXAMPLE 23

0.5 g of Tween 80 were added to 5 grams of Codling- moth pheromone and 19.5 grams of water, and the mixture was homogenized for 5 minutes (9500 R.P.M). 24 grams of acrylate solution (Joncrys SCX 8089) were dissolved in 6 grams of water, and 25 grams of the solution were added to the solution of Tween 80 and pheromone. The whole mixture was homogenized for 5 minutes (9500 R.P.M). The solution was added dropwise through a syringe equipped with a 22G x 1 ½ needle, falling a distance of 60 mm, into 150 ml of 5% CaCl<sub>2</sub> solution. The CaCl<sub>2</sub> solution was contained in a 150 mm diameter vessel, and stirred with a magnetic stirrer in a rate of about 120 R.P.M. The rate of addition was such that 5 minutes

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were required for the 50g addition to take place. The beads formed (2 mm in diameter) were left in the solution for 5 additional minutes. The beads were then separated by filtration through a sieve, washed in water and stored in water. When air-dried, the beads became hard granules of about 1 mm in diameter.

EXAMPLE 24

An emulsion was made in the same manner as in example 23. The emulsion was added to a gellant solution of  $\text{CaCl}_2$  5% using a spraying device as in example 14, to form micron size particles.

EXAMPLE 25

An emulsion was made in the same manner as in example 23 and added dropwise to 150 ml of glacial acetic acid to form beads of around 2 mm in diameter. The beads were left in the acid for about 5 minutes and then filtered and washed thoroughly with water to remove the acid.

EXAMPLE 26

An emulsion was made in the same manner as in example 23. The emulsion was added to a glacial acetic acid using a spraying device as in example 14, to form micron size particles. The particles were left in the acid for few minutes and then filtered and washed with water and kept wet in water.

Using the beads and micron size particles made by the examples above, the amount of volatile material released to the atmosphere was measured resulting in the amounts outlined in Table 1.

TABLE 1:

Sample	Example	Wet Bead diameter (mm)	Dry bead diameter (mm)	Wet bead Weight (mg)	Dry bead Weight (mg)	weight of active ingredient released (% of total)
A	1	1.5 - 2	1 - 1.5	4 - 5	1 - 2	32 (after 63 days)
B	2	1.5 - 2	1 - 1.5	4 - 5	1 - 2	45 (after 37 days)
C	3	1.5 - 2	1 - 1.5	4 - 5	1 - 2	35 (after 37 days)
D	4	1.5 - 2	1 - 1.5	4 - 5	1 - 2	10 (after 52 days)
E	5	1.5 - 2	1 - 1.5	4 - 5	1 - 2	80 (after 52 days)
F	6	1.5 - 2	1 - 1.5	4 - 5	1 - 2	75 (after 63 days)
G	9	1 - 1.5	1	4 - 5	1 - 2	50 (after 42 days)
H	10	1.5 - 2	1 - 1.5	4 - 5	1 - 2	40 (after 90 days)
I	11	2 - 3	0.5 - 1	5	0.5 - 1	85 (after 21 days)
J	14	0.005-0.1	—	—	—	90 (after 22 days)
K	15	0.005-0.1	—	—	—	65 (after 37 days)

TABLE 2:

	Average number of moths per trap per day					
	After 5 days	After 7 days	After 13 days	After 24 days	After 37 days	After 43 days
Experiment	0	3	1	2	0	3
Control	12	32 *	9	42 *	40	30

\* The field was sprayed against PBW one day after the count.

TABLE 3:

Number of days	0	5	10	15	22	35
Percent released 75 Bloom	0	25	70	80	90	95
Percent released 225 Bloom	0	18	35	40	50	70

TABLE 4:

Average number of moths per trap per day			
	After 5 days	After 12 days	After 20 days
Experiment	0	0	1
Control	7.5	16	25

It will be evident to those skilled in the art that the invention is not limited to the details of the foregoing illustrative examples and that the present invention may be embodied in other specific forms without departing from the essential attributes thereof, and it is therefore desired that the present embodiments and examples be considered in all respects as illustrative and not restrictive, reference being made to the appended claims, rather than to the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

**WHAT IS CLAIMED IS:**

1. A sustained release dispersion of water insoluble beads, each bead comprising a polymeric matrix comprised of a protein and a polysaccharide and containing a plurality of emulsion droplets, said droplets being formed from at least one surface active molecule, at least one volatile hydrophobic component and water, wherein said volatile component is released from said water insoluble bead in atmospheric air.
3. A sustained release dispersion of water insoluble beads according to claim 1, wherein said protein is selected from the group consisting of gelatin, albumin, casein and Lactoglobulin.
4. A sustained release dispersion of water insoluble beads according to claim 1, wherein said polysaccharide is selected from the group consisting of sodium alginate, carragenan, guar gum, locus bean gum, chitosan, pectin carboxy methyl cellulose.
5. A sustained release dispersion of water insoluble beads according to claim 1, wherein said surface active molecule is selected from the group consisting of a protein, a monomeric surfactant and a polymeric surfactant.
6. A sustained release dispersion of water insoluble beads according to claim 1, wherein said surface active molecule is selected from the group consisting of ethoxylated sorbitan ester, alkyl ether, a block copolymer and gelatin.
7. A sustained release dispersion of water insoluble beads according to claim 1, wherein each of said beads is of a size between 0.5 micron and 1 mm.

AMENDED SHEET

8. A sustained release dispersion of water insoluble beads according to claim 1, wherein each of said beads is of a size between 5 and 80 microns.
9. A sustained-release polysaccharide-protein water insoluble beads according to claim 1, comprising an emulsion of at least one protein and at least one volatile hydrophobic component contained therein, wherein said volatile component is released from said water insoluble bead in atmospheric air.
10. A sustained-release dispersion of water insoluble beads according to claim 1, wherein said volatile component is a bioactive material.
11. A sustained-release dispersion of bead according to claim 1, wherein said volatile component is a pheromone.
12. A sustained-release dispersion of bead according to claim 11, wherein said pheromone is selected from the group consisting of grandlure, muscalure, gosiplure and disparlure.
13. A sustained-release dispersion of bead according to claim 1, wherein said volatile component is an essential oil.
14. A sustained-release dispersion of bead according to claim 1, wherein said volatile component is a pesticide.
15. A sustained-release dispersion of bead according to claim 1, wherein said volatile component is an attractant.
16. A sustained-release dispersion of bead according to claim 15, wherein said attractant is selected from the group consisting of eugenol, benzyl alcohol, leaf alcohols, aldehydes and acetates.
17. A sustained-release dispersion of bead according to claim 1, wherein said volatile component is an attractant inhibitor.
18. A sustained-release dispersion of bead according to claim 17, wherein said attractant inhibitor is selected from the group consisting of (Z)-9-tetradecenyl formate and (E,E)-10,12-hexadecadienol.

19. A sustained-release dispersion of bead according to claim 1, wherein said volatile component is present in an amount of up to 50% wt./wt.
20. A sustained-release dispersion of bead according to claim 1, wherein said volatile component is present in an amount of up to 20% wt./wt.
21. A sustained-release dispersion of bead according to claim 1, wherein said protein is a gelatin.
22. A sustained-release dispersion of bead according to claim 21, wherein said gelatin is a type B gelatin.
23. A sustained-release dispersion of bead according to claim 1, wherein said volatile component is Eugenol.
24. A sustained-release dispersion of bead according to claim 1, further comprising tannic acid for effecting a slower release rate.
25. A process for preparing a sustained-release dispersion of water insoluble beads for release of a volatile hydrophobic component therefrom in atmospheric air, comprising:
  - a) preparing an oil/water emulsion by homogenizing a volatile hydrophobic component in water, using at least one surface active molecule;
  - b) mixing said emulsion with at least one water-soluble polymer and optionally rehomogenizing the mixture; and
  - c) adding the emulsion prepared in step (b) in a dropwise manner into a gellant solution to form said water insoluble beads.
26. A process according to claim 25, further comprising the step of chemically cross-linking polymers present in said composition.
27. A process according to claim 25, further comprising the step of drying said beads.
28. A process according to claim 25, wherein said gellant solution is selected from the group consisting of an electrolyte solution, a multivalent ion solution, a lower pH solution and a high pH solution.

29. A process according to claim 25, wherein said volatile component is a bioactive material.
30. A process according to claim 25, wherein said volatile component is A pheromone.
31. A process according to claim 30, wherein said pheromone is selected from the group consisting of grandlure, muscalure, gosiplure and disparilure.
32. A process according to claim 25, wherein said volatile component is an essential oil.
33. A process according to claim 25, wherein said volatile component is a pesticide.
34. A process according to claim 25, wherein said volatile component is an attractant.
35. A process according to claim 34, wherein said attractant is selected from the group consisting of eugenol, benzyl alcohol, leaf alcohols, aldehydes and acetates.
36. A process according to claim 25, wherein said volatile component is an attractant inhibitor.
37. A process according to claim 36, wherein said attractant inhibitor is selected from the group consisting of (Z)-9-tetradecenyl formate and (E,E)-10,12-hexadecadienol.
38. A process according to claim 25, wherein said volatile component is present in an amount of up to 50% wt./wt.
39. A process according to claim 25, wherein said volatile component is present in an amount of up to 20% wt./wt.
40. A process according to claim 25, wherein said surface active molecule is a gelatin.
41. A process according to claim 40, wherein said gelatin is a type B gelatin.
42. A process according to claim 25, wherein said gellant is an aqueous metal salt solution.

43. A process according to claim 42, wherein said aqueous metal salt solution comprises a divalent or trivalent metal salt.
44. A process according to claim 42, wherein said metal salt solution comprises chlorides and acetates of calcium, barium and copper.
45. A process according to claim 25, wherein the emulsion of step (b) is sprayed into said gellant to form micron-sized beads.
46. A process according to claim 25, wherein said polymer is a polysaccharide.
47. A process according to claim 46, wherein said polysaccharide is alginic acid.
48. A process according to claim 47, wherein said alginic acid is a water-soluble salt of alginic acid.
49. A process according to claim 47, wherein said alginic acid is a water-soluble salt of organic bases.
50. A process according to claim 47, wherein said alginic acid is selected from the group consisting of sodium, potassium, magnesium, ammonium alginic acid and amines.
51. A process according to claim 47, wherein said alginic acid is present in an amount of about between 0.1 and 5% wt./wt.
52. A process according to claim 47, wherein said alginic acid is present in an amount of about between 1 and 1.5% wt./wt.

**Optional Customer No. Bar Code**



**00140**

PATENT TRADEMARK OFFICE

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**COMBINED DECLARATION AND POWER OF ATTORNEY**

(ORIGINAL, DESIGN, NATIONAL STAGE OF PCT, SUPPLEMENTAL, DIVISIONAL,  
CONTINUATION, OR C-I-P)

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As a below named inventor, I hereby declare that:

**TYPE OF DECLARATION**

This declaration is of the following type:

*(check one applicable item below)*

- original.  
 design.

**NOTE:** *With the exception of a supplemental oath or declaration submitted in a reissue, a supplemental oath or declaration is not treated as an amendment under 37 CFR 1.312 (Amendments after allowance). M.P.E.P. Section 714.16, 7<sup>th</sup> Ed.*

- supplemental.

**NOTE:** *If the declaration is for an International Application being filed as a divisional, continuation or continuation-in-part application, do not check next item; check appropriate one of last three items.*

- national stage of PCT.

**NOTE:** *If one of the following 3 items apply, then complete and also attach ADDED PAGES FOR DIVISIONAL, CONTINUATION OR C-I-P.*

**NOTE:** *See 37 C.F.R. Section 1.63(d) (continued prosecution application) for use of a prior nonprovisional application declaration in the continuation or divisional application being filed on behalf of the same or fewer of the inventors named in the prior application.*

- divisional.  
 continuation.

**NOTE:** *Where an application discloses and claims subject matter not disclosed in the prior application, or a continuation or divisional application names an inventor not named in the prior application, a continuation-in-part application must be filed under 37 C.F.R. Section 1.53(b) (application filing requirements-nonprovisional application).*

- continuation-in-part (C-I-P).

## INVENTORSHIP IDENTIFICATION

**WARNING:** *If the inventors are each not the inventors of all the claims, an explanation of the facts, including the ownership of all the claims at the time the last claimed invention was made, should be submitted.*

My residence, post office address and citizenship are as stated below, next to my name. I believe that I am the original, first and sole inventor (*if only one name is listed below*) or an original, first and joint inventor (*if plural names are listed below*) of the subject matter that is claimed, and for which a patent is sought on the invention entitled:

### TITLE OF INVENTION

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**SUBSTAINED RELEASE POLYMER-BASED WATER INSOLUBLE BEADS**

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### SPECIFICATION IDENTIFICATION

The specification of which:

*(complete (a), (b), or (c))*

(a) [ ] is attached hereto.

**NOTE:** *"The following combinations of information supplied in an oath or declaration filed on the application filing date with a specification are acceptable as minimums for identifying a specification and compliance with any one of the items below will be accepted as complying with the identification requirement of 37 C.F.R. Section 1.63:*

*"(1) name of inventor(s), and reference to an attached specification which is both attached to the oath or declaration at the time of execution and submitted with the oath or declaration on filing;*

*"(2) name of inventor(s), and attorney docket number which was on the specification as filed; or*

*"(3) name of inventor(s), and title which was on the specification as filed."*

*Notice of July 13, 1995 (1177 O.G. 60).*

(b) [ ] was filed on \_\_\_\_\_, [ ] as Application No. \_\_\_\_\_  
[ ] and was amended on \_\_\_\_\_ (if applicable).

**NOTE:** *Amendments filed after the original papers are deposited with the PTO that contain new matter are not accorded a filing date by being referred to in the declaration. Accordingly, the amendments involved are those filed with the application papers or, in the case of a supplemental declaration, are those amendments claiming matter not encompassed in the original statement of invention or claims. See 37 C.F.R. Section 1.67.*

**NOTE:** *"The following combinations of information supplied in an oath or declaration filed after the filing date are acceptable as minimums for identifying a specification and compliance with any one of the items below will be accepted as complying with the identification requirement of 37 C.F.R. Section 1.63:*

- (A) application number (consisting of the series code and the serial number, e.g., 08/123,456);
- (B) serial number and filing date;
- (C) attorney docket number which was on the specification as filed;
- (D) title which was on the specification as filed and reference to an attached specification which is both attached to the oath or declaration at the time of execution and submitted with the oath or declaration; or
- (E) title which was on the specification as filed and accompanied by a cover letter accurately identifying the application for which it was intended by either the application number (consisting of the series code and the serial number, e.g., 08/123,456), or serial number and filing date. Absent any statement(s) to the contrary, it will be presumed that the application filed in the PTO is the application which the inventor(s) executed by signing the oath or declaration.

*M.P.E.P. Section 601.01(a), 7th ed.*

- (c)  was described and claimed in PCT International Application No. IL99/00660 filed on DECEMBER 3, 1999 and as amended under PCT Article 19 on \_\_\_\_\_(if any).

#### **SUPPLEMENTAL DECLARATION (37 C.F.R. Section 1.67(b))**

*(complete the following where a supplemental declaration is being submitted)*

[ ] I hereby declare that the subject matter of the

[ ] attached amendment  
[ ] amendment filed on \_\_\_\_\_.

was part of my/our invention and was invented before the filing date of the original application, above identified, for such invention.

#### **ACKNOWLEDGMENT OF REVIEW OF PAPERS AND DUTY OF CANDOR**

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information, which is material to patentability as defined in 37, Code of Federal Regulations, Section 1.56,

*(also check the following items, if desired)*

[ ] and which is material to the examination of this application, namely, information where there is a substantial likelihood that a reasonable Examiner would consider it important in deciding whether to allow the application to issue as a patent, and

[ ] in compliance with this duty, there is attached an information disclosure statement, in accordance with 37 C.F.R. Section 1.98.

#### **PRIORITY CLAIM (35 U.S.C. Section 119(a)-(d))**

**NOTE:** "The claim to priority need be in no special form and may be made by the attorney or agent if the foreign application is referred to in the oath or declaration as required by Section 1.63. The claim for priority and the certified copy of the foreign application specified in 35 U.S.C. Section 119(b) must be filed in the case of an interference (Section 1.630), when necessary to overcome the date of a reference relied upon by the examiner, when specifically required by the examiner, and in all other situations, before the patent is granted. If the claim for priority or the certified copy of the foreign application is filed after the date the issue fee is paid, it must be accompanied by a petition requesting entry and by the fee set forth in Section 1.17(i). If the certified copy is not in the English language, a translation need not be filed except in the case of interference; or when necessary to overcome the date of a reference relied upon by the examiner; or when specifically required by the examiner, in which event an English language translation must be filed together with a statement that the translation of the certified copy is accurate." 37 C.F.R. Section 1.55(a).

I hereby claim foreign priority benefits under Title 35, United States Code, Section 119(a)-(d) of any foreign application(s) for patent or inventor's certificate or of any PCT international application(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed.

(complete (d) or (e))

- (d) [ ] no such applications have been filed.  
(e) [x] such applications have been filed as follows.

NOTE: Where item (c) is entered above and the International Application which designated the U.S. itself claimed priority check item (e), enter the details below and make the priority claim.

**PRIOR FOREIGN/PCT APPLICATION(S) FILED WITHIN 12 MONTHS  
(6 MONTHS FOR DESIGN) PRIOR TO THIS APPLICATION  
AND ANY PRIORITY CLAIMS UNDER 35 U.S.C. SECTION 119(a)-(d)**

COUNTRY (OR INDICATE IF PCT)	APPLICATION NUMBER	DATE OF FILING DAY, MONTH, YEAR	PRIORITY CLAIMED UNDER 35 USC 119
ISRAEL	127396	3 DECEMBER 1998	[x] YES [ ] NO
			[ ] YES [ ] NO
			[ ] YES [ ] NO
			[ ] YES [ ] NO
			[ ] YES [ ] NO

**CLAIM FOR BENEFIT OF PRIOR U.S. PROVISIONAL APPLICATION(S)  
(35 U.S.C. Section 119(e))**

I hereby claim the benefit under Title 35, United States Code, Section 119(e) of any United States provisional application(s) listed below:

**PROVISIONAL APPLICATION NUMBER**  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**FILING DATE**  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**CLAIM FOR BENEFIT OF EARLIER U.S./PCT APPLICATION(S)  
UNDER 35 U.S.C. SECTION 120**

- [ ] The claim for the benefit of any such applications are set forth in the attached ADDED PAGES TO COMBINED DECLARATION AND POWER OF ATTORNEY FOR DIVISIONAL, CONTINUATION OR CONTINUATION-IN-PART (C-I-P) APPLICATION.

**ALL FOREIGN APPLICATION(S), IF ANY, FILED MORE THAN 12 MONTHS  
(6 MONTHS FOR DESIGN) PRIOR TO THIS U.S. APPLICATION**

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**NOTE:** If the application filed more than 12 months from the filing date of this application is a PCT filing forming the basis for this application entering the United States as (1) the national stage, or (2) a continuation, divisional, or continuation-in-part, then also complete ADDED PAGES TO COMBINED DECLARATION AND POWER OF ATTORNEY FOR DIVISIONAL, CONTINUATION OR C-I-P APPLICATION for benefit of the prior U.S. or PCT application(s) under 35 U.S.C. Section 120.

**POWER OF ATTORNEY**

I hereby appoint the following practitioner(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith.

*(list name and registration number)*

JOSEPH H. HANDELMAN, <u>26179</u>	JULIAN H. COHEN, <u>20302</u>
JOHN RICHARDS, <u>31053</u>	WILLIAM R. EVANS <u>25858</u>
RICHARD J. STREIT, <u>25765</u>	JANET I. CORD, <u>33778</u>
PETER D. GALLOWAY, <u>27885</u>	CLIFFORD J. MASS, <u>30086</u>
IAIN C. BAILLIE, <u>24090</u>	CYNTHIA R. MILLER, <u>34678</u>
RICHARD P. BERG, <u>28145</u>	

*(Check the following item, if applicable)*

- I hereby appoint the practitioner(s) associated with the Customer Number provided below to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith.
- Attached, as part of this declaration and power of attorney, is the authorization of the above-named practitioner(s) to accept and follow instructions from my representative(s).

**NOTE:** "Special care should be taken in continuation or divisional applications to ensure that any change of correspondence address in a prior application is reflected in the continuation or divisional application. For example, where a copy of the oath or declaration from the prior application is submitted for a continuation or divisional application filed under 37 CFR 1.53(b) and the copy of the oath or declaration from the prior application designates an old correspondence address, the Office may not recognize, in the continuation or divisional application, the change of correspondence address made during the prosecution of the prior application. Applicant is required to identify the change of correspondence address in the continuation or divisional application to ensure that communications from the Office are mailed to the current correspondence address. 37 CFR 1.63(d)(4)." Section 601.03, M.P.E.P., 7th Ed

SEND CORRESPONDENCE TO

**Ladas & Parry  
26 West 61<sup>st</sup> Street  
New York, N.Y. 10023**

DIRECT TELEPHONE CALLS TO:

(Name and telephone number)

**WILLIAM R. EVANS  
(212) 708-1930**

*(complete the following if applicable)*

Since this filing is a [ ] continuation [ ] divisional there is attached hereto a Change of Correspondence Address so that there will be no question as to where the PTO should direct all correspondence.

#### **DECLARATION**

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

## SIGNATURE(S)

NOTE: Carefully indicate the family (or last) name, as it should appear on the filing receipt and all other document.

NOTE: Each inventor must be identified by full name, including the family name, and at least one given name without abbreviation together with any other given name or initial, and by his/her residence, post office address and country of citizenship. 37 C.F.R. Section 1.63(a)(3).

NOTE: Inventors may execute separate declarations/oaths provided each declaration/oath sets forth all the inventors. Section 1.63(a)(3) requires that a declaration/oath, inter alia, identify each inventor and prohibits the execution of separate declarations/oaths which each sets forth only the name of the executing inventor. 62 Fed. Reg. 53,131, 53,142, October 10, 1997,

### 1-00 Full name of sole or first inventor

ARNON \_\_\_\_\_ SHANI \_\_\_\_\_  
(Given Name) (Middle Initial or Name) Family (Or Last Name)

Inventor's signature (X) 

Date (X) 25.7.2001 Country of Citizenship ISRAEL

Residence HA'OREN STREET 18, 84965 OMER, ISRAEL TLX

Post Office Address SAME AS ABOVE

### 2-00 Full name of second joint inventor, if any

SHLOMO \_\_\_\_\_ MAGDASSI \_\_\_\_\_  
(Given Name) (Middle Initial or Name) Family (Or Last Name)

Inventor's signature (X) 

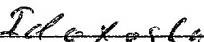
Date (X) 12.7.01 Country of Citizenship ISRAEL

Residence HANERD STREET 36, 96626 JERUSALEM, ISRAEL TLX

Post Office Address SAME AS ABOVE

### 3-00 Full name of third joint inventor, if any

IDO \_\_\_\_\_ YOSHA \_\_\_\_\_  
(Given Name) (Middle Initial or Name) Family (Or Last Name)

Inventor's signature (X) 

Date (X) 25.7.01 Country of Citizenship ISRAEL

Residence KIBBUTZ KFAR-ASA, 85142 MOBILE POST HANEGEV, ISRAEL TLX

Post Office Address SAME AS ABOVE

*(check proper box(es) for any of the following added page(s)  
that form a part of this declaration)*

- [ ] **Signature** for fourth and subsequent joint inventors. *Number of pages added* \_\_\_\_\_

\* \* \*

- [ ] **Signature** by administrator(trix), executor(trix) or legal representative for deceased or incapacitated inventor. *Number of pages added* \_\_\_\_\_

\* \* \*

- [ ] **Signature** for inventor who refuses to sign or cannot be reached by person authorized under 37 C.F.R. Section 1.47. *Number of pages added* \_\_\_\_\_

\* \* \*

- [ ] Added page for **signature** by one joint inventor on behalf of deceased inventor(s) where legal representative cannot be appointed in time. (37 C.F.R. Section 1.47)

\* \* \*

- [ ] Added pages to combined declaration and power of attorney for divisional, continuation, or continuation-in-part (C-I-P) application.

[ ] *Number of pages added* \_\_\_\_\_

\* \* \*

- [ ] Authorization of practitioner(s) to accept and follow instructions from representative.

*(If no further pages form a part of this Declaration,  
then end this Declaration with this page and check the following item)*

[x] This declaration ends with this page.